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Chapter 22

CFD analysis of an evacuated solar still

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Abstract

A mathematical model for an evacuated solar still is presented in this work. Fluent software is used to model and simulate the evaporation and condensation processes inside the solar still. The simulation results showed the transient state of the evaporation and condensation inside the still and the vapour stream lines inside the solar still. Simulation results showed vapour path lines patterns similar to those visualized experimentally in previous literature.

Keywords: solar desalination, modeling, simulation, visualization.

INTRODUCTION

The non-availability of pure water presents a serious problem in many parts of the world. Rivers, lakes and underground water reservoirs has been the major source for fresh water requirements in domestic live, agriculture and industry. However use of water from such sources is not always possible because of the presence of large amount of salts and harmful organisms. The impact of many diseases affecting mankind can be drastically reduced if fresh hygienic water is provided for drinking. Further more, the rapid growth in industry and population all over the world has resulted in a large escalation in demand for fresh water, this leads to an acute fresh water shortage. While an infinite water resource of seawater are available on the earth, but there are large desert/or arid areas. There is definitely a need to produce fresh water from seawater in the 21st century by using much larger scale desalination systems than those in the present century. Solar energy can be used for producing fresh water for biomass growth as well as for potable water.

The present desalination plants of the world now produce approximately 4 billion gallons daily, enough to provide about 4 percent of the world's population with fifteen gallons a day. This is equivalent to providing about one-quarter of one percent of the world's fresh water needs.

Solar still, in many respects, is an ideal source of fresh water for both drinking and agriculture; it is one of the important and technically viable applications of solar energy. There are many types of solar still; the simplest and the more proved one is the basin type. Investigations showed that the basin type solar still has been found to be of limited performance.

The double basin still, diffusion still, and the multiple effects still are of better performance than the basin type solar still.